Research Square

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Safety and Efficacy of Common Endoscopic Treatments in Patients with Decompensated Liver Cirrhosis

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Research Article

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Abstract

Background

The safety and efficacy has always been a concern, when patients with decompensated liver cirrhosis (DLC) receive endoscopic treatments.

Methods

We performed a retrospective study to evaluate the safety and efficacy of common endoscopic treatments including endoscopic resection (ER) and endoscopic retrograde cholangiopancreatography (ERCP) applying to patients with DLC.

Results

81 patients received ER (43 endoscopic mucosal resection (EMR) and 38 endoscopic submucosal dissection (ESD)) and 131 patients were treated by ERCP. There were no significant differences of the rate of degeneration and invariability of Child-Pugh (CP) class and the overall rate of adverse events between two groups (93.8%/8.6% ER vs. 96.2%/15.3% ERCP). Both the degeneration rate of CP class (35.4%) and the rate of adverse events (27.1%) in subgroup C of ERCP group was significantly higher (P=0). The rate of poor outcomes was higher in ERCP group (12.2%) than that in ER group (2.5%) (P=.02). And subgroup C of ERCP group had a higher poor outcome rate (27.1%) (P=0).

Conclusions

ER and ERCP could remove focal lesions or relieve symptoms induced by targeted diseases without significant changes of CP class. Significant benefits and risks coexisted in CP class C patients with DLC when receiving ERCP.

Background

Common endoscopic treatments include esophageal varices related endoscopic treatment, ER (EMR and ESD), and ERCP treatment. Esophageal varices related endoscopic treatment plays a critical role and is usually the first option to prevent or treat portal hypertension–related bleeding which can be catastrophic and fatal [1, 2]. Bleeding, perforation, stricture require attention after EMR and ESD [3, 4]. Bleeding is the most common adverse event of EMR [4]. Pancreatitis, bleeding, and cholangitis are three most common adverse events after ERCP [5]. Patients with DLC is susceptible to acute-on-chronic liver failure (ACLF) after extrahepatic insults [6]. And 17% patients with DLC after ERCP had a higher risk of developing ACLF [7]. In present clinical studies, whether patients have liver cirrhosis (LC) or not and whether liver LC is at compensated stage or not are the grouping indicators to evaluate the safety and efficacy. There is still a paucity of literature available regarding the safety and efficacy of different common endoscopic treatments on patients with DLC. Therefore, we carried out a single center retrospective clinical trial focusing on different common endoscopic treatments in patients with DLC.

The primary purpose of this study was to examine whether liver function could be affected by common endoscopic treatments and whether symptoms induced by targeted diseases could be relieved. The second purpose was to find which kind of endoscopic treatment in which CP class would be riskier and what the associated risk factors would be.

Patients And Methods

Patients: This study was approved by Ethics Committee on Biomedical Research, West China Hospital of Sichuan University (Date of registration: November 19, 2020). Initially, 269 patients (126 ER (61 EMR + 65 ESD) and 143 ERCP) were diagnosed as DLC and received endoscopic treatments from January 1, 2010 to October 1, 2020. Patients were excluded if they did not have an established diagnosis of cirrhosis, had ACLF, were received more than one kind of endoscopic treatment, were aged < 18 years, were pregnant or those with HIV infection, and were without complete clinical information. Data including age, gender, the diagnosis of DLC, LC cause, the presence of varices and related interventions (ligation and transjugular intrahepatic portosystemic shunts (TIPS)), CP class, targeted diseases and symptoms, endoscopic treatment, adverse events, and outcomes were collected and entered after each case. Finally, a total of 212 patients with DLC were collected in this retrospective research. Each of them only received one kind of ER (EMR, ESD, or ERCP) with complete clinical data.

Definitions

(1) The diagnosis of decompensated liver cirrhosis was based on the information of cause, physical examination, serum biomarkers, and imaging findings, which could be responsible to liver cirrhosis and portal hypertension (e.g., the presence of varices, ascites, and hypersplenotrophy). (2) The liver function was assessed according to the Child-Pugh classification. We calculated each patient's CP class before and after endoscopic treatments and counted the total number of patients whose CP class degenerated (e.g., CP class C to B or A, CP class B to A), were invariable (e.g., CP class A to A, CP class B to B, and CP class C to C), and increased (e.g., CP class A to B or C, CP class B to C) in each subgroup and group. In CP C, increased score (e.g., from 10 to 11), decreased score (e.g., from 11 to 10), and invariable score (e.g., from 10 to 10) were also counted. CP classification data was collected in about 5 days after treatments. (3) Patients were given vitamin K and/or fresh plasma if the INR was > 1.5. Similarly, patients with thrombocytopenia were infused with platelets before endoscopic treatments if the platelet count was < 50,000/mm^3. Coagulopathy was corrected to the extent possible before endoscopic treatments. All patients included in the study had received intravenous prophylactic antibiotics. (4) Adverse events found during procedures or in 3 days after procedures were collected mainly including bleeding, perforation, and stricture of ER and pancreatitis, bleeding, and cholangitis of ERCP. Poor outcomes: overall poor outcomes included endoscopy-related mortality and cirrhosis-related mortality at 1 month. Those patients who died after suffering from post-endoscopy adverse events were considered as endoscopy-related mortality and those who died of adverse events of liver cirrhosis such as acute variceal bleed, hepatic encephalopathy, and sepsis were considered as cirrhosis-related mortality. (5) All the patients receiving ER or ERCP were according to corresponding guidelines. Endoscopic treatments were performed by experienced endoscopists using a standard endoscopy. Patients in ERCP group were administrated with either conscious sedation or anesthesia. Patients in ER group were administrated with anesthesia.

Statistical analysis

Continuous variables were expressed as means and standard deviations or as median ranges. Categorical variables were expressed as frequencies and percentages. The differences of parametric variables between two groups were compared using Student's t test. Chi-squared test or Fisher's exact test was used for the comparison of differences in categorical variables as appropriate. A P value of < 0.05 was considered statistically significant. All analyses were performed using SPSS v. 22.0 statistical software (IBM Corp., USA).

Results

1. Patients' characteristics

A total of 212 patients with DLC received ER (EMR or ESD) or ERCP were included in the analysis. There were no significant differences of age and gender between two/three groups (age: ER 60.1 (9.5) vs. ERCP 57.6 (12.6), P =.126; EMR 59.5 (9.98) vs. ESD 60.8 (9.1) vs. ERCP 57.6 (12.6), P =.273). Etiologies of cirrhosis were shown in Table 1. Two main etiologies in two/three groups were viral B hepatitis and alcohol abuse. There was a significant difference of alcohol abuse percentage in two/three groups (ER 23.5% vs. ERCP 7.6%, **P =.002**; EMR 16.3% vs. ESD 31.6% vs. ERCP 7.6%, **P =.01**). (**Table 1**)

2. Safety

2.1 The rate of degeneration and invariability of CP class

We calculated each patient's CP class before and after endoscopic treatments and counted the total number of patients whose CP class degenerated or were invariable in each subgroup and group. There was no significant difference of CP class in two/three groups before and after one kind of endoscopic treatment (the overall rate of degeneration and invariability of CP class: EMR 97.7% vs. ESD 89.5% vs. ERCP 96.2% P=.196). (1) In the level of CP class A, the rate of EMR, ESD, and ERCP was 95.7%, 96%, and 89.5%, respectively (P=.627). (2) In the level of CP class B, the rate of ESD was 75% significantly lower than 100% of EMR and 95.3% of ERCP (**P=.04**). In the level of CP class C, the degeneration rate in ERCP was as remarkably high as 35.4% (17/48). In level C, the rate only included cases with degeneration. (**Table 1**)

2.2 The rate of adverse events

There was no significant difference of the overall adverse event rate in two/three groups before and after one kind of endoscopic treatment (ER 8.6% vs. ERCP 15.3%, P=.205; EMR 7.0% vs. ESD 10.5% vs. ERCP 15.3%, P=.343). In three levels of CP class, the rate of adverse events was not significantly different showed in **Table 1**.

3. Efficacy

3.1 The rate of poor outcomes

There was significant difference of the rate of poor outcomes between ER (2.5%) and ERCP (12.2%) (**P=.02**). In the level of CP class C subgroup of ERCP group, the rate 29.17% (14/131) was highest compared with other 8 subgroups. As the Table 1 showed, the rate was zero or very low in other 8 subgroups. Endoscopy related poor outcomes were only two cases in CP class C subgroup after ERCP. One case with choledocholithiasis before ERCP was because of bleeding after ERCP and coagulation dysfunction, and another case with unexplained bile duct stricture before ERCP was because of cholangitis and sepsis after ERCP. (**Table 1**)

4. Safety and efficacy in ERCP group

4.1 The degeneration and invariability rate of CP class in ERCP group

There was no significant difference of degeneration and invariability rate of CP class between class A subgroup and class B subgroup (89.5% (17/19) vs. 95.3% (61/64), P=.322). The degeneration rate of CP class C subgroup was 35.4% (17/48) and significantly higher than the rate of CP class B subgroup 10.9% (7/64) (**P=.002**). In level C, the rate only included degeneration cases. We also compared the changes of CP classification scores in three levels in ERCP group, unincreased score rate in CP class A, B, and C three levels was 89.5% (17/19), 89.1% (57/64), and 89.6% (43/48), respectively (P=1). (**Table 2**)

4.2 The rate of adverse events in ERCP group

A significant difference was showed in three CP class levels (A 5.3% (1/19) vs. B 9.4% (6/64) vs. C 27.1% (13/48), **P=.02**). There was no significant difference between CP class A and class B subgroup (P=1). The rate of CP class C subgroup was significantly higher than that of CP class B subgroup (**P=.021**). (**Table 2**)

4.3 The rate of poor outcomes in ERCP group

The rate of poor outcomes in three CP class groups has significant difference (A 0% (0/19) vs. B 3.1% (2/64) vs. C 29.2% (14/48), **P=0**). There was no systematic difference between CP class A and B subgroup (P=1). The rate of CP class C subgroup was significantly higher than the rate of CP class B subgroup (**P=0**). (**Table 2**)

4.4 CP class C accounts more proportion in ERCP group

A total of 131 patients was collected in subgroups A (19/131 14.5%), B (64/131 48.9%), and C (48/131 36.6%) based on the CP classification. There was a significant difference between ERCP group and ER group (A 48/81 59.3%, B 29/81 35.8%, and C 4/81 4.9%) (**P_A=0**, P_B=.066, and **Pc=0**). (**Table 3**)

4.5 The analysis of targeted diseases in CP class C of ERCP group

Targeted diseases included 41.6% (20/48) choledocholithiasis without cholangitis, 27.1% (13/48) choledocholithiasis with cholangitis, 8.3% (4/48) post-liver transplantation with adverse events, 6.25% (3/48) hilar occupation, and 16.7% (8/48) unexplained jaundice and bile duct stricture. We put post-liver transplantation with adverse events and hilar occupation together as the end-stage liver group generally with poor outcomes. There were no significant differences in unincreased CP classification score rate (P=.282), degeneration rate (P=.216), adverse event rate (P=.37), and poor outcome rate (P=.194). In subgroup of choledocholithiasis with cholangitis and end-stage liver, the rate of poor outcomes was comparatively higher (38.5% and 57.1%) (**Table 4**). After correcting for confounding factors including age, adverse events, intervention before endoscopic treatment (ligation and TIPS), and specific intervention during endoscopy(stent), logistic regression identified end-stage liver was significantly correlated with poor outcomes (odds ratio (OR) 1.54, 95% confidence interval 1.54–14165.132; P=.032).

Discussion

To evaluate the safety and efficacy of common endoscopic treatments on patients with DLC, we finally collected 212 patients with DLC who received ER (EMR/ESD) or ERCP. Firstly, we found patients were ensured with the similar safety when receiving ER or ERCP after the comparisons of the overall rate of degeneration and invariability of CP class and adverse events between groups. ERCP group was riskier with higher poor outcome rate. Secondly, we found CP class C subgroup of ERCP group had both more benefits and risks after comparing the rate of degeneration and invariability of CP class and adverse events between different CP class subgroups in ERCP group. Thirdly, we focused on CP class C group and found it accounted more proportion in ERCP group and had more cases with cholangitis, post-liver transplantation with adverse events, and hilar occupation which had 9 poor outcomes cases in all out of 14. And end-stage liver might be an independent risk factor of poor outcomes, However, as the sample number was not enough in CP class C subgroup of ERCP and independent variables are all unordered dichotomous or tricomorphous variables, the range of 95% confidence interval was wide.

Liver compensated adaptation and reserve capability of patients with LC is impaired. Symptoms and comorbidities associated with hypohepatia such as coagulopathy and hepatic encephalopathy may appear after endoscopic interventions. Patients with DLC have esophageal varices which can further increase bleeding risk. And receiving TIPS will increase hepatic encephalopathy risk. Endoscopic therapy is challenging and associated with a higher risk of

adverse events. Outcomes of patients with targeted diseases are tightly associated with both targeted diseases' severity and underlying diseases' condition. Therefore, it is critical to evaluate specific issues unique to patients with DLC to optimize outcomes and avoid adverse events, besides the careful evaluation of stage and condition of targeted diseases. We aimed to evaluate the safety and efficacy of ER and ERCP on the condition of DLC. And a brief overview of limited research related to LC and DLC was showed in Table 5.

In the aspect of ER, postoperative bleeding was the most common adverse event in both EMR (from 3.03–21.9%) and ESD (from 4.3–18.2%). The significant statistic differences were controversial, when compared with the bleeding rate in control group from 4.2–7.2%, although the rate in LC groups was demonstrated higher than that in controls. Lesion size including polyp size and superficial cancer size and LC, especially CP class B and C were indicated as independent risk factors of bleeding. In our study, the overall bleeding rate in ER was 4.9% (4/81, 3 (1 A + 1 B + 1 C) EMR and 1 (1 C) ESD). Other three cases with adverse events were infection after ESD, and two cases of three were CP class B and upgraded to CP class C after ESD, which was the reason why the rate of degeneration and invariability of CP class B in ESD group was significantly lower than other two groups. Regarding efficacy, there was no significant difference of targeted diseases' treatments between LC groups and control group. **In** Table 5, en bloc resection rate was from 81.8–97.7%. In an systematic review, both en bloc removal and R0 resection were achieved in nearly 90% of cases [8]. In our study, all targeted polyps and superficial cancers were successively removed.

In the aspect of ERCP, Table 5 demonstrated the overall adverse event rate was from 16.1–35%, and 73.1% was shown in one research with DLC. Cholangitis was focused and its rate was from 0.3–32.7%. Cholangitis at admission was also an independent risk factor of morality. Bleeding rate was from 2.1–10.9%, and might be associated with sphincterotomy. Post-ERCP pancreatitis (PEP) rate was from 2–30.8%. The rate of ACLF was 11.4%, and associated with LC and ERCP. MELD > 16 or 18 and CP class C were also considered as independent risk factors of adverse events. A systematic review with a total of 6,505 patients from 15 studies concluded 4.58% bleeding rate, 3.68% PEP rate, and 1.93% cholangitis, and a higher overall rate of adverse events in cirrhosis patients with a pooled OR of 1.63 (higher bleeding rate with OR of 2.05 and PEP with OR of 1.33) [9]. Another systematic review based on 31 studies showed a high technical success rate more than 90% [10]. In our study, the overall adverse event rate was 15.3% (including 3.8% (5/131) cholangitis, 4.6% (6/131) PEP and 2.3% (3/131) bleeding) and the rate of ACLF was 4.5% only in ERCP group.

In our study, significantly higher proportion of alcoholic cause of LC in ER group especially in ESD group (31.6%) was shown which is one of the risk factors of gastrointestinal cancer. Therefore, we concluded the proportion in other researches demonstrated from 4.67–63.3%. In terms of higher proportion of CP class C in our study with 31.4%, more severe than patients in ER, the similar result could be found in Table 5. Both of two results indicated their specific epidemiology.

To the best of our knowledge, the safety and efficacy of common endoscopic treatments on patients with DLC was firstly carried out and comparisons was first made based on different endoscopic therapies and CP classes in patients with DLC which was rarely involved in present studies. Finally, we found common endoscopic treatments (EMR, ESD, and ERCP) were technically feasible in patients with DLC. And more assessment should be made before ERCP, as it was riskier with a higher poor outcome rate. It could be further focused on CP class C group in ERCP which had both more benefits and risks. (Table 5) [7, 11–23]

Limitations

There are some limitations. Firstly, although this study was limited by a single-center design, it could reduce some bias from endoscopic technique levels and patients' compositions. Secondly, other treatments such as peroral endoscopic myotomy, only endoscopic ablation, and gastrointestinal stents were not included. Thirdly, we did not further analyze clinical indicators, long-term outcomes, and the specific location and characteristics of lesions in ER group, as the overall rate of adverse events (7/81, 4 bleeding and 3 infection) and poor outcomes (2/81) were low. Using different endoscopic treatments as the grouping indicator could contribute more to comparing changes of CP class and evaluating the safety.

Conclusions

In summary, it was equally safe for CP class A and B patients with DLC to receive common endoscopic treatments including ER and ERCP. Focal lesions or symptoms induced by targeted diseases could be treated without significantly changes of CP class. Significant benefits and risks coexisted when CP class C patients with DLC received ERCP.

Abbreviations

Acute-on-chronic liver failure (ACLF)

Child-Pugh (CP)

Decompensated liver cirrhosis (DLC)

Endoscopic mucosal resection (EMR)

Endoscopic resection (ER)

Endoscopic Retrograde Cholangiopancreatography (ERCP)

Endoscopic submucosal dissection (ESD)

Liver cirrhosis (LC)

Odds ratio (OR)

Post-ERCP pancreatitis (PEP)

Transjugular intrahepatic portosystemic shunts (TIPS)

Declarations

Ethics approval and consent to participate: This study was approved by Ethics Committee on Biomedical Research, West China Hospital of Sichuan University (Date of registration: November 19, 2020; No. 1115, 2020). The research complied with the conditions of consent free and was approved to dispense with informed consent by the Ethics Committee.

Consent for publication: Not applicable

Availability of data and materials: The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests: The authors have no conflicts of interest to declare.

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Authors' contributions: Conception and design: Bing Hu and Hang Yang; Analysis and interpretation of the data: Bing Hu and Hang Yang; Drafting of the article: Hang Yang; Final approval of the article: Bing Hu and Hang Yang

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References

1. Nett A, Binmoeller KF: **Endoscopic Management of Portal Hypertension-related Bleeding**. *Gastrointestinal endoscopy clinics of North America* 2019, **29**(2):321–337.
2. Garcia-Tsao G, Abraldes JG, Berzigotti A, Bosch J: **Portal hypertensive bleeding in cirrhosis: Risk stratification, diagnosis, and management: 2016 practice guidance by the American Association for the study of liver diseases**. *Hepatology (Baltimore, Md)* 2017, **65**(1):310–335.
3. Maple JT, Abu Dayyeh BK, Chauhan SS, Hwang JH, Komanduri S, Manfredi M, Konda V, Murad FM, Siddiqui UD, Banerjee S: **Endoscopic submucosal dissection**. *Gastrointestinal endoscopy* 2015, **81**(6):1311–1325.
4. Hwang JH, Konda V, Abu Dayyeh BK, Chauhan SS, Enestvedt BK, Fujii-Lau LL, Komanduri S, Maple JT, Murad FM, Pannala R *et al*: **Endoscopic mucosal resection**. *Gastrointestinal endoscopy* 2015, **82**(2):215–226.
5. Chandrasekhara V, Khashab MA, Muthusamy VR, Acosta RD, Agrawal D, Bruining DH, Eloubeidi MA, Fanelli RD, Faulx AL, Gurudu SR *et al*: **Adverse events associated with ERCP**. *Gastrointestinal endoscopy* 2017, **85**(1):32–47.
6. Zhao RH, Shi Y, Zhao H, Wu W, Sheng JF: **Acute-on-chronic liver failure in chronic hepatitis B: an update**. *Expert review of gastroenterology & hepatology* 2018, **12**(4):341–350.
7. Leal C, Prado V, Colan J, Chavez-Rivera K, Sendino O, Blasi A, Roura P, Juanola A, Rodriguez de Miguel C, Pavesi M *et al*: **Adverse Events and Acute Chronic Liver Failure in Patients With Cirrhosis Undergoing Endoscopic Retrograde Cholangiopancreatography: A Multicenter Matched-Cohort Study**. *The American journal of gastroenterology* 2019, **114**(1):89–97.
8. Repici A, Pagano N, Hassan C, Cavenati S, Rando G, Spaggiari P, Sharma P, Zullo A: **Endoscopic submucosal dissection of gastric neoplastic lesions in patients with liver cirrhosis: a systematic review**. *Journal of gastrointestinal and liver diseases: JGLD* 2012, **21**(3):303–307.
9. Mashiana HS, Dhaliwal AS, Sayles H, Dhindsa B, Yoo JW, Wu Q, Singh S, Siddiqui AA, Ohning G, Girotra M *et al*: **Endoscopic retrograde cholangiopancreatography in cirrhosis - a systematic review and meta-analysis focused on adverse events**. *World journal of gastrointestinal endoscopy* 2018, **10**(11):354–366.
10. Søreide JA, Karlsen LN, Sandblom G, Enochsson L: **Endoscopic retrograde cholangiopancreatography (ERCP): lessons learned from population-based national registries: a systematic review**. *Surgical endoscopy* 2019, **33**(6):1731–1748.
11. Jeon JW, Shin HP, Lee JI, Joo KR, Pack KM, Cha JM, Park JJ, Lim JU, Lim K: **The risk of postpolypectomy bleeding during colonoscopy in patients with early liver cirrhosis**. *Surgical endoscopy* 2012, **26**(11):3258–3263.
12. Soh H, Chun J, Hong SW, Park S, Lee YB, Lee HJ, Cho EJ, Lee JH, Yu SJ, Im JP *et al*: **Child-Pugh B or C Cirrhosis Increases the Risk for Bleeding Following Colonoscopic Polypectomy**. *Gut and liver* 2020, **14**(6):755–764.

13. Lee HS, Park JJ, Kim SU, Lee JE, Leem GL, Kim Y, Kim BK, Park JY, Kim DY, Ahn SH *et al*: **Incidence and risk factors of delayed postpolypectomy bleeding in patients with chronic liver disease**. *Scandinavian journal of gastroenterology* 2016, **51**(5):618–624.
14. Huang RJ, Perumpail RB, Thosani N, Cheung R, Friedland S: **Colonoscopy with polypectomy is associated with a low rate of complications in patients with cirrhosis**. *Endoscopy international open* 2016, **4**(9):E947-952.
15. Choi YK, Ahn JY, Kim DH, Jung KW, Na HK, Choi KD, Lee JH, Song HJ, Lee GH, Jung HY: **Efficacy and safety of endoscopic submucosal dissection for gastric neoplasms in patients with compensated liver cirrhosis: a propensity score-matched case-control study**. *Gastrointestinal endoscopy* 2018, **87**(6):1423–1431.e1423.
16. Tsou YK, Liu CY, Fu KI, Lin CH, Lee MS, Su MY, Ohata K, Chiu CT: **Endoscopic Submucosal Dissection of Superficial Esophageal Neoplasms Is Feasible and Not Riskier for Patients with Liver Cirrhosis**. *Digestive diseases and sciences* 2016, **61**(12):3565–3571.
17. Choe WH, Kim JH, Park JH, Kim HU, Cho DH, Lee SP, Lee TY, Lee SY, Sung IK, Park HS *et al*: **Endoscopic Submucosal Dissection of Early Gastric Cancer in Patients with Liver Cirrhosis**. *Digestive diseases and sciences* 2018, **63**(2):466–473.
18. Choi JH, Kim ER, Min BH, Choi D, Kang KJ, Lee JH, Rhee PL, Kim JJ, Rhee JC: **The feasibility and safety of the endoscopic submucosal dissection of superficial gastric neoplastic lesions in patients with compensated liver cirrhosis: a retrospective study**. *Gut and liver* 2012, **6**(1):58–63.
19. Jagtap N, Nabi Z, Tandan M, Ramchandani M, Sharma M, Lakhtakia S, Rao PN, Gupta R, Kalapala R, Basha J *et al*: **Is It Safe to Perform Endoscopic Retrograde Cholangiopancreatography in Decompensated Cirrhosis?** *Journal of clinical and experimental hepatology* 2019, **9**(5):554–560.
20. Lee JC, Kim JS, Kim HW, Cho IK, Lee J, Jang ES, Lee SH, Hwang JH, Kim JW, Jeong SH *et al*: **Outcome of endoscopic retrograde cholangiopancreatography in patients with clinically defined decompensated liver cirrhosis**. *Journal of digestive diseases* 2018, **19**(10):605–613.
21. Kim JY, Lee HS, Chung MJ, Park JY, Park SW, Song SY, Bang S: **Bleeding Complications and Clinical Safety of Endoscopic Retrograde Cholangiopancreatography in Patients with Liver Cirrhosis**. *Yonsei medical journal* 2019, **60**(5):440–445.
22. Macías-Rodríguez RU, Ruiz-Margáin A, Rodriguez-Garcia JL, Zepeda-Gómez S, Torre A: **Risk factors associated with complications in cirrhotic patients undergoing endoscopic retrograde cholangio-pancreatography**. *European journal of gastroenterology & hepatology* 2017, **29**(2):238–243.
23. Navaneethan U, Njei B, Zhu X, Kommaraju K, Parsi MA, Varadarajulu S: **Safety of ERCP in patients with liver cirrhosis: a national database study**. *Endoscopy international open* 2017, **5**(4):E303-e314.

Tables

Table 1
Patients' characteristics, adverse events, and poor outcomes

	ERCP	**ER**			
	ERCP	EMR	ESD	P value (ER vs ERCP)	P value (ERCP vs EMR vs ESD)
Total number	131	43	38		
Age, years, mean (SD)	57.6(12.6)	59.5(9.98)	60.8(9.1)	0.126	0.273
Sex, male, n (%)	71(54.2%)	28(65.1%)	27(71.1%)	0.061	0.127
Cause					
HBV	84	29	24	0.883	0.917
Alcohol	10(7.6%)	7(16.3%)	**12(31.6%)**	**0.002**	**0.01**
Schistosoma	1	2	1		
AIH	4	1	1		
HCV	2	1			
PBC	9	2			
Others	5	1			
SBC	16				
D and I rate of CP	126(96.2%)	42(97.7%)	34(89.5%)	0.319	0.196
CP A, n (%) (Invariability)	17(89.5%)	22(95.7%)	24(96%)	0.317	0.627
CP B, n (%)	61(95.3%)	17(100%)	9(75%)	0.371	0.04
CP C, n (%) (Degeneration)	**17(35.4%)**	0(0%)	0(0%)		
Adverse events	20(15.3%)	3(7.0%)	4(10.5%)	0.205	0.343
CP A, n (%)	1(5.3%)	1(4.30%)	0(0.00%)	0.49	0.525
CP B, n (%)	6(9.4%)	1(5.9%)	3(25%)	0.497	0.213
CP C, n (%)	**13(27.1%)**	1(33.3%)	1(100%)	0.569	0.433
Poor outcomes	**16(12.2%)**	1(2.3%)	1(2.6%)	**0.02**	
CP A, n (%)	0(0.0%)	0(0.0%)	1(4.0%)		
CP B, n (%)	2(3.13%)	0(0.0%)	0(0.0%)		
CP C, n (%)	**14(29.17%)**	1(33.33%)	0(0.0%)		

AIH autoimmune hepatitis, CP Child–Pugh, D and I rate of CP degeneration and invariability of CP class, EMR endoscopic mucosal resection, ER endoscopic resection, ERCP endoscopic retrograde cholangiopancreatography, ESD endoscopic submucosal resection, HBV hepatitis B virus, HCV hepatitis C virus, PBC primary biliary cholangitis, SBC secondary Biliary Cirrhosis, SD standard deviation.

Table 2
The degeneration and invariability rate of CP class, adverse events, and poor outcomes in ERCP group

	CP A	CP B	CP C	*P value* (A vs B)	*P value* (B vs C)	*P value* (A vs B vs C)
Before ERCP	19	64	48			
After ERCP						
Degeneration	0	7(10.9%)	**17(35.4%)**		**0.002**	
Invariability	17	54	31			
Increase	2	3	0			
D and I rate of CP	17(89.5%)	61(95.3%)		0.322		
Adverse events	1(5.3%)	6(9.4%)	13(27.1%)	1	**0.021**	**0.02**
Bleeding		1(Papillary muscle tear)	2			
Perforation						
Stricture						
Sepsis	1	2	2			
PEP		3	3			
ACLF			6			
Poor outcomes	0(0%)	2(3.1%)	**14(29.17%)**	1	**0**	**0**

ACLF acute-on-chronic liver failure, CP Child–Pugh, D and I rate of CP degeneration and invariability of CP class, ERCP endoscopic retrograde cholangiopancreatography, PEP post-ERCP pancreatitis.

Table 3
Patients composition of CP class in ER group and ERCP group

	ERCP	ER	*P value*
CP A	19(14.5%)	48(60.8%)	**0**
CP B	64(64.2%)	29(51.5%)	0.066
CP C	48(31.4%)	4(4.9%)	**0**
	131	81	

Table 4
Targeted diseases and related changes of CP class, adverse events, and poor outcomes in CP class C subgroup of ERCP group

	Total number	**Choledocholithiasis without cholangitis**	**Choledocholithiasis with cholangitis**	**End stage live (Post transplantation + HCC)**	**Unexplained jaundice and bile duct stricture**	***P value***
Total number	48	20	13	4 + 3	8	
Unincreased CP score	22	7(35%)	5(38.5%)	3 + 2(71.4%)	5(62.5%)	0.282
Degeneration of CP class	17	5(25%)	5(38.5%)	2 + 2(57.1%)	3(62.5%)	0.216
Adverse events	13	6(30%)	4(30.8%)	0 + 0(0%)	3(37.5%)	0.37
Poor outcomes	14	4(20%)	5(38.5%)	2 + 2(57.1%)	1(12.5%)	0.194
HCC hepatocellular carcinoma						

Table 5

Overview of common endoscopic treatments in patients with LC

Polypectomy Reference	Background and method	Causes and proportion	Patients' composition	Targeted diseases	Aim	Results	Independent risk factors
Jeon JW [9]	LC (Retrospective Single center)	HBV 10 (33.3 %) Alcohol 19 (63.3 %)	30 patients (21(70.0 %) A, 8 (26.7 %) B and 1 (3.3 %) C)	Colonoscopic Polypectomy	IPPB and DPPB	IPPB: 3.03 % (2/66) removed polyps	Polyp size
Soh H [14]	LC and chronic hepatitis (Retrospective Single center)	HBV 72.2% Alcoholic 4.67%	700 A, 100 B, 14 C, and 453 chronic hepatitis	Colonoscopic Polypectomy	IPPB and DPPB	Total 21.9% in B and C (immediate 14.5% + delayed 4.4%) Total 4.9% in hepatitis (immediate 4.6% + delayed 0.2%)	Polyp size, CP class B and C
Lee HS [15]	LC and controls without LC (Retrospective Single center)	HBV 58.8% Alcoholic 30.0%	80 patients with LC and 72 controls without LC	Colonoscopic polypectomy	DPPB	LC 13.8% Controls without LC 4.2%	Polyp size, LC
Huang RJ [16]	LC (Retrospective Single center)		307 patients (A 85.7%, B 13.0%, and C 1.3 %)	Colonoscopic polypectomy	Bleeding	Bleeding 7.5%	
ESD							
Choi YK [8]	CLC and case controls without LC (Retrospective Single center score–matched case-control)	HBV 51.9% Alcoholic 31.6%	158 patients with LC (A 96.8%, B 3.2%, C 0%) and 158 controls without LC	ESD for gastric neoplasms	Efficacy and safety	Bleeding 10.1% + perforation 1.9% + death 10.8% in LC, Bleeding 8.3% + perforation 0% + death 3.2% in controls. En bloc resection 96.8% and curative resection 89.9% in LC En bloc resection 96.8% and curative resection 91.1% in controls.	Size of the specimen
Tsou YK [17]	LC and controls without LC (Retrospective Single center)		11 patients with LC (A 81.8% + B 18.2%) + 39 controls without LC	ESD for superficial esophageal neoplasms	Efficacy and safety	Bleeding 18.2 % in LC and 0% in controls without LC. En block resection 81.8 % and R0 resection 77.8 % in LC En block resection 89.7 % and R0 resection 94.3 % in controls	

ACLF acute-on-chronic liver failure, CP Child–Pugh, CHB chronic hepatitis B, CLC compensated LC, DLC decompensated LC, DPPB delayed postpolypectomy bleeding, EMR endoscopic mucosal resection, ERCP endoscopic retrograde cholangiopancreatography, ESD endoscopic submucosal resection, HBV hepatitis B virus, IPPB immediate postpolypectomy bleeding, LC liver cirrhosis, PEP post-ERCP pancreatitis.

Polypectomy Reference	Background and method	Causes and proportion	Patients' composition	Targeted diseases	Aim	Results	Independent risk factors
Choe WH [18]	LC and CHB (Retrospective Multicenter)	HBV 100%	43 patients with LC (A 74.4% B 25.6%) 47 patients with CHB	ESD for early gastric cancer	Efficacy and safety	Bleeding 9.3%, Perforation 4.7%, and Death 19% in LC Bleeding 6.4%, Perforation 2.1%, and Death 4.4% in CHB En bloc resection 97.7% and R0 resection 95.3% in LC. Both En bloc resection and R0 resection 97.9% in CHB	
Choi JH [19]	CLC and controls without LC (Retrospective Single center)	HBV 69.6%	23 patients with LC (A 87.0% and B 13.0%) and 69 controls	ESD for superficial gastric neoplastic lesions	Efficacy and safety	Bleeding 4.3%, perforation 0% in LC. Bleeding 7.2% Perforation 1.4% in controls. En bloc resection 82.6%, R0 resection 91.3%, and curative resection 82.6% in LC. En bloc resection 94.2%, R0 resection 98.6%, and curative resection 92.8% in controls.	
ERCP							
Jagtap N [20]	LC (Retrospective Single center)	HBV 21.7% Alcoholic 28.4%	261 patients (A 17.3%, B 51.7%, and C 31%)	Sphincterotomy in ERCP	Efficacy and safety	Overall adverse events: 16.1% (bleeding 4.5% + PEP 5.8% + cholangitis 2.7%) (A 9.1%, B 11.1%, and C 27.4%)	Adverse events: MELD > 18 CP class C Morality: cholangitis at admission

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Polypectomy Reference	Background and method	Causes and proportion	Patients' composition	Targeted diseases	Aim	Results	Independent risk factors
Lee JC [10]	DLC and CLC (Retrospective Single center)	HBV 53.2% Alcoholic 35.1% in CLC HBV 55.8% Alcoholic 23.1% in DLC	94 CLC 54 DLC	ERCP	Efficacy and safety	Overall adverse events 30.9% (cholangitis 18.1% + PEP 6.4%), and clinical success 95.7% in CLC. Overall adverse events 73.1% (cholangitis 32.7% + PEP 30.8%) clinical success 78.8% in DLC.	DLC Age > 65 years
Kim JY [21]	LC and case controls without LC (Retrospective Single center 1:3 propensity score matching)		192 patients with LC and 576 controls without LC	Bleeding complications and clinical safety	Safety	Bleeding 4.7% in LC Bleeding 10.9% in controls.	LC
Leal C [7]	LC with ERCP LC with non-ERCP interventions, and LC without interventions (Retrospective multicenter matched-cohort study)	Overall HBV 50.6% Alcoholic 41.8%, Sphincterotomy HBV 60% Alcoholic 37.9% in DLC	Overall 158 LC (A 38.6% + B and C 61.4%) and 283 Controls, Sphincterotomy 95 LC (A 36.8% + B and C 63.2%) and 236 Controls	Adverse events and acute chronic liver failure	Safety	Overall adverse events 17.1% vs 9.5% (cholangitis 6.3% vs 1.8% + bleeding 5.7% vs 3.53%) in LC. Overall adverse events 24.2% vs 10.1% (cholangitis 7.3% vs 1.7% + bleeding 9.4% vs 3.4%) in Sphincterotomy. ACLF 11.4% in ERCP group vs 17.5% in no-ERCP intervention group vs 3.2% in no-intervention group.	
Macías-Rodríguez RU [22]	DLC and controls (Retrospective Single center)		37 DLC 37 controls	Risk factors associated with complications in ERCP	Safety	Overall adverse events 35% (bleeding 5% + PEP 2%) in DLC. 24% (bleeding 2% + PEP 2%) in controls.	Sphincterotomy MELD > 16
Navaneethan U, Njei B [23]	LC and controls (Retrospective National Inpatient Sample database)		ERCP between 3228 patients with LC and 12912 controls	adverse events of ERCP	Safety	Bleeding 2.1%, PEP 12%, and cholangitis 0.3% in LC Bleeding 1.2%, PEP 10.4%, cholangitis 0.4% in controls	Bleeding: compensated cirrhosis, therapeutic ERCP, and sphincterotomy

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